

REMARKS

Claims 1 - 26 are pending in this application. Claims 9, 10, 12, 14, and 16 have been amended. Claims 1 - 26 stand rejected.

Claims 10, 12, 14, and 16 stand objected to due to informalities. These claims have been amended to correct these informalities. Claim 9 has been amended to correct an informality.

Claims 1 -26 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Venus (U.S. Patent No. 5, 668,501) (“Venes”) in view of Mathur et al. (U.S. Patent No. 6,661,457) (“Mathur”). Reconsideration is respectfully requested.

Claim 1 recites, *inter alia*, a method of controlling gain in a pixel array comprising “changing the gain of an amplifier in a gain stage of a sensor in response to a signal read out from a pixel array in the sensor, wherein said gain stage is in an output path to an analog to digital converter for readout; and changing the power consumption of the amplifier in the gain stage in response to changing the gain.”

The claimed invention provides a sensor “with a gain stage that includes a differential amplifier with an adjustable gain....The differential amplifier includes an input transistor with an adjustable transconductance....[A] transconductance controller can select a transconductance setting that is associated with a selected gain setting in order to more efficiently match the power consumption of the amplifier to its gain.” (Spec., ¶ 0005).

The claimed invention seeks to address the problem that occurs when “the unity gain frequency of its amplifier is selected to satisfy the settling time for the worst-case condition....For any gain setting lower than the maximum gain setting, the amplifier draws more power than is necessary for the required settling time.” (Spec., ¶ 0004).

Venes seeks to address the problem that “[i]n mixed analogue and digital applications it is, however, desirable to be able to change the transconductance in response

to a binary control signal. This usually involves using a D/A converter for converting the binary control signal into an analogue control signal. A drawback of this method is that a D/A converter is needed.” (Venes, Col. 1, 51-56).

Venes teaches a “transconductance amplifier with a transconductance which is digitally variable.” Venes also teaches “variable gain stage comprising a transconductance amplifier according to the invention” and an “automatic gain stage comprising a variable gain stage according to the invention.” (Venes, Col. 1, 59 - 67).

Venes fails to disclose or suggest “changing the gain of an amplifier in a gain stage of a sensor in response to a signal read out from a pixel array in the sensor.... wherein said gain stage is in an output path to an analog to digital converter for readout.” (Emphasis added) As generically noted in the Office Action, “Venes does not teach the gain stage being within a sensor having an active (APS) pixel array having pixels arranged in rows and columns and the signals as a pixel signal read out from the pixel using a readout circuit.”

The deficiencies in Venes vis-à-vis the claimed invention are not remedied by the Mathur reference. Mathur seeks to address the problem that in image arrays “[e]xisting read-out circuitry generates mixed color data....This requires sorting of the mixed color data stored in the memory. This increases processing requirements at the image processor which contributes to increased cost, power consumption and weight of a digital camera. Therefore, there is a need for facilitating color extraction which reduces the requirements for processing at a digital image processor.” (Mathur, Col. 2., l. 12 -27) Mathur discloses an architecture for efficient extraction of data from photo sensors. (Mathur, Col. 2., l. 29 - 31). Mathur does not teach how to modify or use Venes to attain the claimed invention.

Further, there is no motivation or suggestion provided in the references to combine the teachings of Venes with the teachings of Mathur as these patents are directed to solving very different problems. There is no suggestion in either on how or why their teachings could be combined.

Accordingly, the rejection of claim 1 should be respectfully withdrawn for at least the reasons provided above.

Claims 2-7 depend from claim 1 and incorporate, directly or indirectly, the limitations thereof and are allowable for at least the reasons stated above. Additionally, with respect to claim 6, neither Venes nor Mathur, separately, or in combination, teach “the power consumption setting is selected from three power consumption settings, each of three power consumption settings being associated with a different plurality of gain settings.” With respect to claim 7, neither Venes nor Mathur, separately, or in combination, teach “each of the plurality of gain settings is associated with a different one of the plurality of power consumption settings.” Accordingly, withdrawal of the rejection of claims 2-7 is respectfully requested.

Claim 8 recites, *inter alia*, a method of controlling gain in a pixel array comprising “selecting one of a plurality of gain settings in response to a signal read out from a pixel array in a sensor; generating two or more bias currents having bias current values associated with the selected gain setting; and applying said two or more bias currents to a plurality of parallel transistors in an amplifier in a gain stage of the sensor in order to change the input transconductance of the amplifier, wherein said gain stage is in an output path to an analog to digital converter for readout. ”

Venes fails to disclose or suggest “selecting one of a plurality of gain settings in response to a signal read out from a pixel array in a sensor.” (emphasis added) Nor does Venes disclose or suggest “applying said two or more bias currents to a plurality of parallel transistors in an amplifier in a gain stage of the sensor in order to change the input transconductance of the amplifier, wherein said gain stage is in an output path to an analog to digital converter for readout.” (emphasis added) As generically noted in the Office Action, “Venes does not teach the gain stage being within a sensor having an active (APS) pixel array having pixels arranged in rows and columns and the signals as a pixel signal read out form the pixel using a readout circuit.”

The deficiencies in Venes vis-à-vis the claimed invention are not remedied by the Mathur reference. Mathur is directed at facilitating color extraction on signals received from a pixel array. Mathur does not teach how to modify or use Venes to attain the claimed invention.

Further, there is no motivation or suggestion provided in the references to combine the teachings of Venes with the teachings of Mathur as these patents are directed to solving different problems. There is no suggestion in either on how or why their teachings can be combined.

Accordingly, the rejection of claim 8 should be respectfully withdrawn for at least the reasons provided above.

Claims 9 – 10 depend from claim 8 and incorporate, directly or indirectly, the limitations thereof and are allowable for at least the reasons stated above. Additionally, with respect to claim 9, neither Venes nor Mathur, separately, or in combination, teach “associating each of a plurality of input transconductance settings to a plurality of gain settings, each input transconductance setting being associated with a given set of bias current values.” Additionally, with respect to claim 10, neither Venes nor Mathur, separately, or in combination, teach “associating an input transconductance setting to each of a plurality of gain settings, each input transconductance setting being associated with a given set of bias current values.” Accordingly, withdrawal of the rejection of these claims is respectfully requested.

Claim 11 recites, *inter alia*, an apparatus comprising “a gain stage for a sensor of an active pixel sensor array, wherein said gain stage is in an output path to an analog to digital converter for readout and said gain stage having a differential amplifier including a gain selector operative to select one of a plurality of gain settings in response to a signal from said pixel array, an input transistor having a variable input transconductance, and a transconductance controller operative to select an input transconductance of the input transistor in response to a selected gain setting.”

Venes fails to disclose or suggest “a gain stage for a sensor of an active pixel sensor array, wherein said gain stage is in an output path to an analog to digital converter for readout and said gain stage having a differential amplifier including a gain selector operative to select one of a plurality of gain settings in response to a signal from said pixel array.” (emphasis added) Nor does Venes disclose or suggest “a transconductance controller operative to select an input transconductance of the input transistor in response to a selected gain setting.” (emphasis added) As generically noted in the Office Action, “Venes does not teach the gain stage being within a sensor having an active (APS) pixel array having pixels arranged in rows and columns and the signals as a pixel signal read out from the pixel using a readout circuit.”

The deficiencies in Venes vis-à-vis the claimed invention are not remedied by the Mathur reference. Mathur is directed at facilitating color extraction on signals received from a pixel array. Mathur does not teach how to modify or use Venes to attain the claimed invention.

Further, there is no motivation or suggestion provided in the references to combine the teachings of Venes with the teachings of Mathur as these patents are directed to solving different problems. There is no suggestion in either on how or why their teachings can be combined.

Accordingly, the rejection of claim 11 should be respectfully withdrawn for at least the reasons provided above.

Claims 12 -17 depend from claim 11 and incorporate, directly or indirectly, the limitations thereof and are allowable for at least the reasons stated above. Additionally, with respect to claim 14, neither Venes nor Mathur, separately, or in combination, teach “a bias current selector operative to select values for a first bias current and a second bias current associated with a selected gain setting, and a bias current generator operative to generate a first current having the selected value for the first bias current value and apply said first current to the first bias current supply and to generate a second current having the

selected value for the second bias current value and apply said second current to the second bias current supply.” Accordingly, withdrawal of the rejection of these claims is respectfully requested.

Claim 18 recites, *inter alia*, a sensor comprising “a pixel array comprising a plurality of pixels arranged in rows and columns; a read-out section operative to read out signals generated by pixels in the pixel array; a gain stage wherein said gain stage is in an output path to an analog to digital converter for readout and said gain stage having a differential amplifier including a gain selector operative to set the differential amplifier to one of a plurality of gain settings in response to a pixel signal read out from the pixel array, an input transistor having an input transconductance and including a first plurality of parallel transistors connected to a first bias current supply and a second plurality of parallel transistors connected to a second bias current supply, and a transconductance controller operative to change the transconductance of the input transistor to match a selected gain setting by selectively applying different bias currents to at least one of said first and second bias current supplies for different gain settings.”

Venes fails to disclose or suggest “a read-out section operative to read out signals generated by pixels in the pixel array... a gain selector operative to set the differential amplifier to one of a plurality of gain settings in response to a pixel signal read out from the pixel array.” (emphasis added) As generically noted in the Office Action, “Venes does not teach the gain stage being within a sensor having an active (APS) pixel array having pixels arranged in rows and columns and the signals as a pixel signal read out from the pixel using a readout circuit.”

The deficiencies in Venes vis-à-vis the claimed invention are not remedied by the Mathur reference. Mathur is directed at facilitating color extraction on signals received from a pixel array. Mathur does not teach how to modify or use Venes to attain the claimed invention.

Further, there is no motivation or suggestion provided in the references to combine the teachings of Venes with the teachings of Mathur as these patents are directed to solving different problems. There is no suggestion in either on how or why their teachings can be combined.

Accordingly, the rejection of claim 18 should be respectfully withdrawn for at least the reasons provided above.

Claims 19 – 21 depend from claim 18 and incorporate, directly or indirectly, the limitations thereof and are allowable for at least the reasons stated above. Additionally, with respect to claim 19, neither Venes nor Mathur, separately, or in combination, teach “a gain decoder operative to select one or more bias current values in response to a selected gain response from a plurality of bias current values; and a bias generator operative to generate and apply said one or more bias current values to at least one of the first and second bias current supplies.” Accordingly, withdrawal of the rejection of these claims is respectfully requested.

Claim 22 recites, *inter alia*, a method of controlling gain in a pixel array comprising “changing the gain of an amplifier in a gain stage of a sensor in response to a signal read out from a pixel array in the sensor; and changing a gain bandwidth (GBW) of the amplifier in the gain state in response to changing the gain.”

Venes fails to disclose or suggest “changing the gain of an amplifier in a gain stage of a sensor in response to a signal read out from a pixel array in the sensor; and changing a gain bandwidth (GBW) of the amplifier in the gain state in response to changing the gain.” (emphasis added) As generically noted in the Office Action, “Venes does not teach the gain stage being within a sensor having an active (APS) pixel array having pixels arranged in rows and columns and the signals as a pixel signal read out from the pixel using a readout circuit.”

The deficiencies in Venes vis-à-vis the claimed invention are not remedied by the Mathur reference. Mathur is directed at facilitating color extraction on signals received from a pixel array. Mathur does not teach how to modify or use Venes to attain the claimed invention.

Further, there is no motivation or suggestion provided in the references to combine the teachings of Venes with the teachings of Mathur as these patents are directed to solving different problems. There is no suggestion in either on how or why their teachings can be combined.

Accordingly, the rejection of claim 22 should be respectfully withdrawn for at least the reasons provided above.

Claims 23 -26 depend from claim 22 and incorporate, directly or indirectly, the limitations thereof and are allowable for at least the reasons stated above. Accordingly, withdrawal of the rejection of these claims is respectfully requested.

Additionally, the Applicants respectfully disagree with the Office Action with respect to claims 1- 4, 8, 10-11, and 13 – 26 where it is suggested that “it is would have been obvious to... to use the gain stage...as taught by Mathur in the device and method of Venes....” The Applicants also respectfully disagree with the Office Action with respect to claims 5 -7, 9, and 12 where it is suggested that “it is would have been obvious to... [to provide certain features] in the apparatus and method of Venes in view of Mathur to provide an appropriate level of adjustability and coordination for system functionality without excessive system complexity.” There is nothing evident in either cited reference providing motivation for the combination, and if even if motivation existed, the claimed invention would still not be obtained.

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to pass this application to issue.

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Respectfully submitted,

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